DOCUMENT RESUME

ED 249 055 SE 045 060

AUTHOR	Brophy, M.; Fryars, M.
TITLE	Techniques and Measurements. Seychelles Integrated Science. [Teacher and Pupil Booklets]. Unit 1.
INSTITUTION	National Inst. of Pedagogy (Seychelles).
SPONS AGENCY	Ministry of Education and Information (Seychelles).
PUB DATE	83
NOTE	56p.; Document contains several pages of marginal legibility. For units 2 through 13 of this series, see SE 045 061-072.
PUB TYPE	Guides - Classroom Use - Materials (For Learner) (051) -- Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Curriculum Development; Integrated Curriculum; Junior High Schools; *Laboratory Procedures; Laboratory Safety; *Measurement Equipment; *Measurement Techniques; *Science Activities; Science Curriculum; Science Education; *Science Programs; *Secondary School Science; Skill Development; Units of Study
IDENTIFIERS	*Seychelles Integrated Science Progra

ABSTRACT

Seychelles Integrated Science (SIS), a 3-year laboratory-based science program for students (ages 11-15) in upper primary grades 7, 8, and 9, was developed from an extensive evaluation and modification of previous P7-P9 materials. This P7 SIS unit is designed to: (1) introduce students to and familiarize them with working in the school laboratory; (2) make them aware of the need for care and caution while working in the laboratory; and (3) instruct them in the correct use of the metric ruler, balance, graduated cylinder, thermometer, and stopwatch. Provided for the unit is a student workbook and a set of teaching notes. The teaching notes include an overview of the SIS program, the general aims of the unit, and a lesson plan for each topic area. Each lesson plan includes a suggested time frame, a list of objectives, a list of equipment needed, and a suggested lesson format. This format includes suggestions for introducing the lesson, instructional strategies (emphasizing procedures for student activities), and evaluation methods. The student workbook includes procedures for completing the unit activities and a list of new words keyed to page numbers in the workbook. (JN)

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seychelles integrated science

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Unit 1

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TEACHING NOTES

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Seychelles Integrated Science

Introduction

Seychelles Integrated Science (SIS) is a three-year laboratory based science programme for pupils in P 7, P8 and P9 classes. It assumes that the pupils will have six, forty-minute periods of science each week, at least four of which will be in a laboratory. The programme aims to develop in the pupils;

1 The ability and willingness to look at and observe their surroundings and events in their surroundings objectively.

2 The ability and willingness to use a logical and rational "scientific" approach to everyday life based on objective observation.

3 A knowledge and understanding of scientific and natural phenomena and an ability to communicate with others about these.

4 An ability and willingness to use and relate scientific knowledge and skills to everyday life.

5 An awareness of the influence that science and technology have both on their everyday life and on the lives of other people, plants and animals.

If these five aims are achieved by the pupils then it is expected that they will be able to observe and record information about their surroundings and events in their surroundings using a systematic and controlled approach. They will be able to interpret and evaluate both qualitative and quantitative information so that they can reach a conclusion and substaniate it. They will be able to relate the scientific knowledge and vocabulary, appropriate to a fourteen year old, to the problems they encounter in their everyday life and they will be able to read and interpret relevant information so that they can reach informed decisions regarding the use and application of science and technology in their environment.

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To help achieve these aims SIS uses student texts, teacher's handbooks and a variety of audio visual materials. For 1984 it is hoped also to produce a series of pupils' background reading materials.

There are sixteen student units or booklets and a set of teaching notes for each unit. If you do not receive either the unit or the teaching notes please ask your school administrator to contact the Science Section of NIP. The student materials are produced in booklet form and we no longer use the worksheet format. So please do not let your pupils write on the booklets - you may need them again next year. Student's observations and records of experiments should be kept in a science notebook - or as we would prefer to call it a science workbook. The booklets are sequenced in nature so as far as possible go through the programme following the sequence of the units.

Units 1 to 5 in P 7,
Units 6 to 11 in P 8, and
Units 12 to 16 in P 9.

The units are intended for all classes within each form. There are some activities within each unit, however, which may only suit faster working or more able pupils.

Teaching notes are supplied for each unit and in these we set out the general aims of the unit and the objectives of the individual topics and lessons. We also list the equipment you will need for the lessons and give some idea of the time required to teach each topic. A <u>suggested</u> lesson plan is described for every lesson. You do not have to follow these lesson plans. They are sent only to help. We do ask, however, that you ensure that the pupils achieve the objectives set for each topic. You may wish to adapt the plan to better suit your school or locality, please do so but do make sure that at the end of the topic the pupils have achieved the stated objectives. The objectives are the most important guideline for the whole programme. Future examinations and evaluations will test the pupils' achievement of the objectives.

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In addition to the pupil's texts and teacher's notes there will also be some video tapes, 35 mm slides and cassette tapes linked to a number of the units. Where these are needed they will be referred to in the teaching notes. Please check through each set of notes as soon as you receive them to help you to order the audio visual materials and to borrow equipment from the Science Centre. If there are items of equipment that you need and they are not available in your school you should be able to borrow them from the Science Centre via your technician. Audio visual materials will either be sent out as part of your school resources or you can borrow them from the Television Liason Officer at NIP (Ext 162).

The new programme being introduced in 1983 has been developed following an extensive evaluation and modification of the previous P7 - P9 materials. The evaluation and modification has been carried out by the Science Section of NIP with the cooperation of the Inspectorate, Tutors at the TTC, the National Youth Service and teachers in P7 to P9 classes. The new materials aim to make the programme more relevant and meaningful to pupils. They are also designed to make lesson preparation easier and less time consuming for the teacher. Please study the aims of the programme carefully. You will see that in the programme we stress the importance of teaching children to USE the knowledge and skills that they acquire in science. We hope that not only will they be ABLE to use them but, just as important, they will WANT to use the scientific knowledge and skills they learn in school in their everyday lives at home and at work.

We ask you, the teachers, to please ensure that as often as possible, it is the pupils who carry out the practical work, it is the pupils who discuss and talk about what they see and do and it is the pupils who use their own words to write about their work.

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For some topics you may wish to carry out a demonstration experiment - but please make sure that for every double period lesson there is at least one activity that the pupils carry out. Avoid giving the pupils notes to copy down. When notes are needed , for example, when recording what happened in an experiment or describing the function of an organ, get the pupils to explain or describe what they observed or did, and then let them write their own notes. With some slower working classes you may need to help the pupils by writing out their verbal explanation on the board. As the pupils learn more about writing notes you will need only write the 'key' words of explanation and allow the pupils to use these as their guidelines.

Try to encourage the children to think about what they are doing. Avoid using questions to which they can give 'yes' or 'no' answers. Questions such as " Is this right ?" How many times ?" "Can you see what happens ?" Instead ask questions which require the pupils to think about their answers and to give an answer of a sentance or more. 'What happened when you did that ?" "Why do you think it happened ?" "What did you see ?" "What would happen if .....?" "Tell me how you would .....?"

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The P 7 - P 9 programme can only achieve its aims if science teachers frequently allow the pupils to

1. carry out practical work themselves,
2. think about and discuss what they observe and do, and
3. write about what they observe, learn and do, using their own words.

If teachers fail to do this, the pupils will become bored and indifferent and may come to reject science both in school and in everyday life. If the children enjoy and understand school science then there is every chance that they will understand and appreciate its use in their everyday lives and in their society.

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The Goals of Unit 1

The title of Unit 1 is Science in the Laboratory and the main purpose of the unit is to INTRODUCE pupils to working in a school science laboratory.

In the early sections of the unit we have concentrated on familiarizing children with their new surroundings while at the same time getting them to understand the need to take care when working in the laboratory. We then move on to showing the pupils how to use various essential basic items of equipment. In this part of the unit we place great emphasis on teaching the pupils how to USE correctly five important items:

> The metre rule, the balance, the measuring cylinder, the thermometer and the stop-watch/or clock.

The primary purpose of these activities is to develop in the pupils the measurement skills involved in using the five items and to encourage them to want to use instruments for taking measurements. The unit has 3 main goals, therefore:

1 to introduce and familiarize the pupils to working in the school laboratory

2 to make them aware of the need for care and caution when working there;

3 to encourage and instruct the pupils in the correct use of the metre rule, balance, measuring cylinder, thermometer and stop-watch.

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LESSON PLAN

Unit 1 — Topic 1

Looking Around
the Laboratory

Time

This is a double period lesson and we hope that all pupils will be able to complete up to the end of Section 1.8. It is expected, however, that only the more able pupils will have time to complete Section 1.9.

Objectives

In this lesson we simply want to INTRODUCE the pupils to working in a school science laboratory and familiarise them with some of the apparatus they will see and use in a laboratory. We want to introduce them to various items of equipment as part of their programme, instead of having little groups of pupils wandering around the laboratory during their first few weeks poking and prying at the various pieces of equipment (such as the aquarium and incubator). We want to let them look at and touch and handle the equipment that they will normally see around them, so that in the future they will see and accept them as a natural and interesting part of the environment of a science laboratory.

The objective of the lesson, therefore, is to introduce the pupils to the laboratory and to some items of equipment. At this stage we do NOT expect the pupils to learn to spell the names of the various items, nor to be able to identify the different parts of the items. For the first lesson we merely want to let them handle and look at some of the equipment that they will see around them in the laboratory.

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They should, however, be able to read, say and write the words <u>science</u> and <u>laboratory</u>.

Equipment

Cards with the number and name of each item, for example | 1.2 Incubator |

1.1 Model steam engine - with water in boiler, fuel block or methylated spirit. Do not let the pupils handle beakers or bottles of spirit and keep these well away from flames. Once the fuel has been lit by one group, the others will not need to relight it. The technician should refuel it if necessary.

1.2 Have the incubator switched on at least 2 hours before the class begins as for normal use with the temperature within the range 39°C - 42°C.

1.3 Use two, three or more magnets on a <u>wooden</u> (not iron or steel) stand and place the magnets so that the like poles (or faces) repel each other. (If you do not have a wooden stand available you can use a pencil or paint brush handle held in a metal clamp.) At the end of the lesson make sure you collect <u>all</u> magnets.

1.4 Choose the best selection of specimens you have available to interest and stimulate the pupils e.g. preserved centipedes, lizards and chick embryos.

1.5 Vacuum pump, pressure plate, rubber tubing, bell jar, balloon, thread, vaseline. Blow up the balloon, tie it with thread and leave it in a bell jar. Grease the mouth of the bell jar with vaseline and place it on the pressure plate. Connect the pressure plate to the vacuum pump with <u>firm</u> rubber tubing. Test it out before the lesson to ensure that the balloon expands as the pressure falls.

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1.6 If no aquarium is already set up a temporary one may be set up using river water and T lapia or guppy fish (gourzon). Ensure that there is a pump to aerate the water.

1.7 The technician should set up in advance, a circuit board, two cells, three bulbs, three switches with connecters as shown in the pupils book. The switches should be labelled A, B and C.

1.8 Set up and focus the microscope on a slide showing a part of an insect such as a cock-reaches' leg, a mosquite's head or a fly's wing.

A Suggested Lesson Format

Introduction Since this is probably the first time the pupils will have been in the laboratory, we suggest you emphasise to them that for science we do not use an ordinary classroom but because of the amount of practical work we need a special room. In Science they will not be sitting and watching the teacher - they will do the practical work, so we need this special room called a laboratory. They should be able to read, say and write the words 'science' and 'laboratory'.

Activity You should give clear and precise instructions to the pupils as to how they will carry out the activities. Tell them what group they are in, where the group is to go and when and how each group will move to the next activity.

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Discussion and Evaluation

After all the groups have completed the 8 activities, you should get the class to talk with you about what they saw and did at each of the activities o 'stations'. Encourage the pupils to describe what they observed and enlarge upon what they have written in their books, by asking, for example, what happened when they pressed the light switches (1.7) and "why" did they think that had happened.

With some faster working or more able pupils you may complete the work and still have some time available. We suggest that you use this time to shew and discuss some other items of equipment which the pupils may see and use from time to time in the laboratory.

For example, a hand lens or a retort stand and clamp. Here again we are not trying to teach them how a hand lens works but rather getting them to recognize it and to write a sentence or two about what that piece of equipment does.

For this lesson the evaluation questions should be fairly simple. For example, . asking the pupils to name and identify the different items they have worked with and by asking them to say what happened at each 'station'. With Section 1.8, for instance, we could ask, "Who can tell me what we call this piece of equipment?" "What did we use it for?

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LESSON PLAN

Unit 1 — Topic 2

Using the
Laboratory 2.0 - 2.1

Time — A double period.

Objectives — In this lesson we want the pupils to learn about the safety rules that must be observed in the science laboratory. We are not interested so much in making them learn a list of rules by heart but rather in getting them to understand what the rules are and the reasons for such rules. You will need to draw up a set of rules to suit your own laboratory and school. We suggest, however, that you INCLUDE the following:

1. Pupils should not enter the laboratory unless the teacher (or technician) is present.

2. They must never handle, touch, smell or move any chemical or equipment unless told to do so by the teacher.

3. They must never touch or turn on electricity, gas or water supplies unless told to do so by the teacher.

4. They should keep the passage ways in the laboratory clear and free from obstructions - such as school bags.

5. They must not run or play about in the science laboratory.

6. They should never eat or drink in the laboratory.

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If pupils are asked to taste something as part of an experiment you should point out that this is an exception to the normal rules and take care that you give clear instructions as to what the pupils are to taste. 'Tasting' even common laboratory chemicals like copper chloride or potassium dichromate can have serious and even lethal effects.

At this stage we do not expect the pupils to learn detailed safety rules (such as how to heat liquids in a test tube). These specific rules will be dealt with when the pupils are asked to perform the relevant activities. At this stage we want the children to know and understand the broad 'general' rules for good conduct in the laboratory.

At the end of this lesson the pupils should be able to recall and explain - using their own words - the safety rules you have described for your laboratory. They should also be able to identify common changes in the laboratory and breaches of your rules - both in the situation and in photographs, drawings and films.

Equipment

A chart or poster of the rules you have devised for general conduct in the laboratory.

A Suggested Lesson Format

Introduction

Remind the pupils about the work they did in their previous lesson and ask them to tell you why we need a special room for science. Ask them for the name of this special room. Leading from these answers you can tell the pupils that since we do so much practical work in the laboratory we must take extra care when working there. You can then ask the pupils what they think would be good rules to stop people getting hurt or having accidents in the laboratory.

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Activity

2.0 You should select the most useful and relevant ideas suggested by the pupils in order to build up a list on the board. When you have this list made up you can then suggest comparing it with the list you have already prepared on your chart - which you should now produce. Praise the pupils for each point that they have suggested and discuss the additional ones that they have not thought of. The pupils can then write down your list of rules into their work books.

2.1 When the pupils have finished writing down your list you can ask them to study the drawing in their unit (P3) of bad behaviour in the laboratory. Ask them to work with a partner to see how many different 'dangers' they can spot and write down.

Discussion and Evaluation

After allowing the pupils 10 or 15 minutes to do this get them to report their observations to the class. Allow different pupils to identify the dangers - do not let one pupil give the complete list. As each pupil identifies a danger ask him/her why is it a danger - what do they think might happen?

For this lesson the best evaluation will be to ask the children to 'see if we can remember' the rules we need for working in a laboratory. Take down your poster for a while and then ask the pupils to tell you about the rules - in their own words. Try not to judge or evaluate the whole class by the replies of one or two 'good' pupils from near the front but check the understanding of a wide selection of pupils from all parts of the room.

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You should end the lesson by reminding the children that the rules we were dealing with were not just 'today's lesson' but rules that we must observe everyday in the laboratory - rules that are important to help prevent accidents and injuries.

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LESSON

Unit 1 Topic 2

Using the Laboratory
2.2 - 2.4

Time A double period

Objectives In this lesson we introduce the pupils to some specific safety rules for handling chemicals and glassware and then let them go on to handle some chemicals and glassware. We do NOT expect them to know or understand the chemistry of the reactions in this activity. We merely want them to be able to describe in their own words what they observe.

Using their own words the pupils should be able to recall, explain and give reasons for the following laboratory safety rules.

A.

(i) Never taste, eat, drink, touch, sniff or smell any chemical, food or drink in the laboratory unless told to do so by the teacher.

(ii) Never stir or dip your finger, your pen or pencil into any liquid in the laboratory.

(iii) Never shake bottles in the laboratory.

(iv) Never wipe, clean or dry glassware with your clothing or handkerchief.

(v) Never point the mouth of a test-tube at yourself or anyone else.

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(vi) If you spill a chemical or break any glassware report it immediately to the teacher.

(vii) Always hold bottles carefully. Never lift them by the stopper or neck but by holding them underneath and by the sides.

(viii) Never leave glassware or chemicals near the edge of a bench or desk. Leave them close to the middle of the desk well away from edges and sinks.

B.

In the second part of the lesson the pupils handle some chemicals and glassware.

At the end of this part of the lesson the pupils should be able to describe (using their own words):-

(i) that when calcium is added to water, bubbles appear in the liquid coming from the calcium and the tube becomes warm;

(ii) that when water is added to powder A (an hydrous copper sulphate) the white powder will turn blue;

(iii) that when water is added to powder B (Enos or a similar mixture of sodium bicarbonate and citric acid) it fizzes.

Equipment

2.3 One test-tube, one small piece of calcium and one spatula for EACH group of students. Preferably using groups of 5 pupils or less.

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2.4 Two (100 or 250 ml)) beakers, one spatula for each group. For the class you will need an evaporating basin of anhydrous copper sulphate (make sure this is kept dry) and an evaporating basin of Enos.

A Suggested Lesson Format

Introduction

Remind the pupils of their last science lesson when they learned about the general rules for working in the laboratory. Ask them to see how well they can remember the rules. Encourage as many pupils as possible to become involved in the discussion.

Activity

Teaching on from the general rules we can now introduce pupils to what we may call the special rules for working with chemicals and glassware. Here we can introduce the "rules" one at a time writing each rule on the board as we introduce it. One good way of helping the pupils to understand is by breaking them up into groups of 3 or 4 and then allowing each group to discuss, what they think the rule means and why such a rule is necessary. The teacher can then get different groups to report on what they have agreed on. When you are satisfied that the pupils understand the rules you can then get them to write them into their work books.

For activity 2.3, warn the children that often in science it would be dangerous to use our fingers to lift chemicals - so we use a special type of spoon called a spatula. Show them how to use one and then ask them to carry out the activity. When they report what has happened - suggest that now perhaps they can see why we do not lift chemicals with our fingers. For top stream forms you may reinvorce this by <u>demonstrating</u> how a SMALL piece of sodium (or potassium) reacts violently when added to water in a trough.

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For activity 2.4 let the children work in groups of two or three and ask them to use the spatula to lift the powders from the container into the test-tubes without spilling any.

Discussion and Evaluation

Ask different children to tell the class what they observed when they added water to the two powders. You can also ask them to describe the shape of the spatula and to suggest why we use this special instrument rather than an ordinary spoon.

Check the pupils' understanding of the rules for handling chemicals and glassware. Try to avoid simply asking them to repeat or recite the rules but rather ask them to explain them. For example, by asking questions like "In science what way should we lift a bottle? Why do it like that? Why is it bad to leave a beaker at the edge of a desk? Where should you leave it?"

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LESSON PLAN

Unit 1 — Topic 3

Guessing and Measuring Length

Time

A double period lesson. All pupils should complete Sections 3.0 and 3.1. Only the more able pupils may have time to complete Section 3.2.

Objectives

At the end of the lesson the pupils should know that for measurement of length to be accurate we must use a measuring instrument. They should also know that we measure length in metres and that there are 100 centimetres in a metre and that the abbreviation for centimetres is cm. They should be able to estimate and demonstrate with their hands a length of approximately 1 metre (to within 20 cm) and be able to use a metre rule to measure:-

(a) lengths of between 2 cm and 1 metre to an accuracy of $\pm$ 1 cm;

(b) lengths of between 1 and 5 metres to an accuracy of $\pm$ 5 cm.

The primary objectives of this topic are related to the measurement of length but we would also like you to take the opportunity to introduce the pupils to the agriculture project in the school.

In Section 3.1 the pupils are asked to take measurements of various parts of the agriculture project. When you bring them out to the project we suggest you spend 5 to 10 minutes. (With the help of the agriculture technician explain what happens at the agriculture project. Show them the various activities that are carried out there and tell them that this is part of the science programme and that later on part of their science course will involve working on the agriculture project.)

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Equipment

3.0 Pupils own rulers.

3.1 One metre rule for each group or pair of pupils.

3.2 One bell jar and 1 metre of string. One milk tin and half a metre of string.

A Suggested Lesson Format

Introduction

P7 pupils will already have heard about and met metres and centimetres as units of length. You could introduce the lesson, therefore, by asking the class simple questions such as, "How far do you think it is from here to the door? or "How tall do you think -- -- is?"

If the pupils answer using the terms metre you can then ask them to explain to you what they mean by this word metre. If they use feet and yards, you can say "yes, good - but can anyone think of a more modern way of talking about length?" or "Good, but in science, we do not talk about yards, feet and inches. We measure length using another unit - can anyone tell me the name of another unit of length?" When you have the word metre then tell the children that today they are going to learn more about measuring length in metres.

Activity

3.0 Ask the children to carry out activity 3.0 checking as they do so that they know how to measure with a ruler. If a large number cannot do so accurately, revise this with the whole class.

3.1 Ask the pupils to guess the length of a metre, for example by asking them to name something which is about 1 metre away from them. You can then give each group a metre stick and ask them to check their guess.

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Get the pupils to hold out their arms so that their hands are one metre apart and make sure everyone has an approximate idea of a length of 1 metre. Ask the pupils to look carefully at the metre sticks. Show them the one centimetre mark and ask them to show you a distance of 1 centimetre with their finger and thumb. Ask them to count how many centimetres are in a metre.

Now ask them to carry out activity 3.1. Both you and the technician should supervise the children while they are taking measurements to ensure that they do so with a reasonable degree of accuracy. Remember when you bring them out to the agriculture project to spend 5 to 10 minutes taking about the project.

3.2 Only a few of the very able pupils or classes will have time to carry out the activities. Again check that they do so with a reasonable degree of accuracy.

Discussion and Evaluation

Taking the children out to the agriculture project may mean that you have little time left at the end of the lesson for prolonged discussion but try to make sure you spend at least 5 minutes checking that all the pupils know, the approximate length of a metre and that there are 100 centimetres in a metre. You can check how accurately they can use the metre stick or ruler by asking each pupil to measure the length of his/her work book and then writing down the answer for you or the technician to check.

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LESSON PLAN

Unit 1 — Topic 4

Guessing and Measuring Weight

Time

A double period lesson. All pupils should complete Sections 4.0 and 4.1. Only the more able may have time to complete 4.2.

Objectives

At the end of this lesson the pupils should know that for measurements of weight to be accurate we must use a balance. They should know that we measure weight in kilograms, that there are 1000 grams in a kilogram and that 'g' is the abbreviation for grams. The pupils should have a "realistic" idea of what a weight of 1 kilo feels like, eg. they should be able to distinguish by feel the difference between unmarked 2 kilo, 1 kilo and 100 g weights. Use a balance to measure weights of up to 250 g to an accuracy of $\pm$ 5 g.

Equipment

4.0 Each group of 4 to 5 pupils should have a bag of known weight (500 g). A $\frac{1}{2}$ kilo bag of rice, flour or sugar will do. Otherwise ask your technician to prepare plastic bags filled with sand. Each group will also need one empty bottle or specimen tube of less than 100 g weight and a similar bottle filled with water. For the shoe use in this activity a 'flip-flop' sandal.

4.1 Each group should have a balance which weighs up to 1000 g.

4.2 Each group will need a 100 ml bottle filled with water. You will also need one only 250 ml tin of evaporated milk and one empty tin of the same size.

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A Suggested Lesson Format

Introduction

Ask the children to say how shopkeepers measure out onions and potatoes and if they were going to buy these things what weight would they ask for?

Introduce the word kilogram and then ask how they would buy small quantities or weights of vegetable such as garlic. Discuss the idea that kilogram is a weight of 1000 grams.

Activity

Get the children to work in groups of 4 or 5, so that every child will get the opportunity to feel the weight of each object. Encourage them to discuss with the others in their group why they have chosen the 'estimate' they have.

When the children are using the balance both you and the technician should go from group to group showing and explaining to them how to use and read it accurately.

Discussion and Evaluation

Ask the pupils to look at the estimates they and the other people in their group made and then to look at the real weights of the objects. Then ask them to suggest why it is important to have weighing machines. Suggest they think about a dispenser or nurse making up medicines in a clinic. Check that the pupils know that the unit of weight is the kilogram and that there are 1000 g in 1 kilogram. You and the technician should also check that everyone can use the balance accurately. You can best do this towards the end of activity 4.1.

With none-able pupils you could show them the bottle of water and ask them how they would find out the weight of the water in the bottle. For all 4 activities in Section 4.2 allow the pupils to solve the problem for themselves. You can help them solve the problem but <u>do not</u> tell them how to do it.

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LESSON PLAN

Unit 1 — Topic 5

Guessing and Measuring Volume

Time

A double period lesson. All pupils should complete sections 5.0, 5.1 and 5.2. Only the more able pupils may have time to complete section 5.3.

Objectives

At the end of this lesson the pupils should know that for measurements of volume to be accurate we must use a graduated vessel, such as a measuring cylinder. They should know that we measure volume in litres, that there are 1000 millilitres in a metre and that the abbreviation for millilitres is ml. The pupils should have a 'realistic' idea of what a volume of 1 litre of a liquid would look like e.g. they should be able to estimate the volume of a can of cooking oil to within 500 ml. They should be able to use a measuring cylinder to measure volumes of up to 250 ml to an accuracy of $\pm$ 5 ml.

Equipment

5.0, 5.1 A selection of 3 or 4 everyday bottles or containers such as a squash bottle, cooking oil bottle and wine bottle. Each group should have a flat bottom flask (500 ml), a beaker (100 ml), a conical flask (250 ml) and a gas jar.

5.2 Each group should have a 250 ml measuring cylinder.

5.3 As for 5.2 plus a table spoon, cup and lemonade bottle. Only one of each item is needed since the groups can share them.

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A Suggested Lesson Format

Introduction	Show the pupils the selection of bottles and tins that you have and ask them how much oil or squash you would get if you bought a bottle/tin of this type. If the pupils use "gallons" ask them for the "new"/"modern" word or unit we use to measure volume. Ask the children to name some other liquids that they buy known volumes of, eg. petrol and kerosene.
Activity	Get each pupil to write down their estimate of the volume of each of the 4 vessels in section 5.0. Again get each pupil to write down their answers in 5.1. In section 5.2 demonstrate to the whole class how to use and read a measuring cylinder. Then both you and the technician should move around from group to group working and helping the pupils to take their readings. Try to get the pupils to 'solve the problem' for themselves of how to use the 250 ml cylinder to measure the volume of the spoon. If they have a problem suggest they start with the cup.
Discussion and Evaluation	Draw a table on the board with columns for the measured volume of each of the 4 vessels. Then get one member of each group to 'call out' or write on the board the volume they measured. When you have all results the pupils to call out the estimates they made in section 5.1.

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Walk around the class and as you do ask the pupils to show you where they have their answer written down. After 10 or 12 pupils have called out their estimates discuss with the class why the measurements are all very similar but the estimates vary so much.

Check that the pupils remember that the unit of volume is the litre and that there are 1000 millilitres in a litre.

Take out a container (such as a cooking oil can) - one that you have not shown the pupils so far and ask them to estimate the volume of liquid it would hold. Get each pupil to write down his/her answer and with the technician check as many of their answers as possible.

During activity 5.2 and 5.3 you and the technician should also check to see that the pupils are reading the measuring cylinder correctly.

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LESSON PLAN

Unit 1 — Project 1

Using What we Have Learnt

Time

A double period lesson.

Objectives

At the end of the lesson pupils should know and understand how to measure the volume of a large household and garden vessal. They should know the names of at least two fruits or vegetables growing in the school and be able to measure samples of the two fruits while they are still on the plant.

They should also be able to calculate how long a hose-pipe must be if it is to reach from the water tap to the furthest point in the garden.

Equipment

For every 12 pupils you will need one 250 ml measuring cylinder, a beaker (250 ml), one balance and two metre rules. You should also make sure that you have a watering can, a hose-pipe and some fruit or vegetable in the agriculture garden.

A Suggested Lesson Format

Introduction

Revise what the pupils have learnt about the measurement of length, weight and volume. Question them about the various units they have met and ask them tc describe how to use the metre rule, the balance and the measuring cylinder.

Activity

Let the pupils read their worksheet in the classroom and then allow them 10 minutes to discuss their ideas with EACH other. As far as possible allow the pupils to solve the problems themselves. Let them suggest ideas to you on how they will solve the problems.

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LESSON PLAN

Unit 1 — Project 1

Using What We Have Learnt

Time

A double period lesson.

Objectives

At the end of the lesson pupils should know and understand how to measure the volume of a large household and garden vessal. They should know the names of at least two fruits or vegetables growing in the school and be able to measure samples of the two fruits while they are still on the plant.

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Equipment

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Introduction

Revise what the pupils have learnt about the measurement of length, weight and volume. Question them about the various units they have met and ask them to describe how to use the metre rule, the balance and the measuring cylinder.

Activity

Let the pupils read their worksheet in the classroom and then allow them 10 minutes to discuss their ideas with EACH other. As far as possible allow the pupils to solve the problems themselves. Let them suggest ideas to you on how they will solve the problems.

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In order to make the best use of your facilities you can divide the class into sections of about 12 pupils. Then divide each section into 3 groups. While the first group in each section works on problem 1, the second group may work on problem 2 and the third group on problem 3. Allow each group to spend about 15 minutes on each problem.

Discussion and Evaluation

Bring the pupils back into the classroom. Ask one member of each group to report to the class how his/her group solved the first problem. Allow 2 or three groups to report. Then repeat this for the second and third problems. You should get the pupils to write 2 - 4 lines in their own words about what they did for each problem.

For slower classes you could help by either writing the pupils words on the board or writing a number of key words which they could use. e.g. watering can, beaker, measuring cylinder, count.

Both you and your technician should check the pupils work as they are doing it. At this stage you should encourage the pupils to express their ideas and thoughts rather than emphasize neatness and correct spelling.

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LESSON PLAN

Unit 1 — Topic 6

Guessing and Measuring Time

Time

A double period lesson. All pupils should complete sections 6.0 and 6.1. Only the more able pupils may have time to complete section 6.2

Objectives

At the end of this lesson the pupils should know that for measurements of time to be accurate we must use a clock or a watch. They should know that we measure time in hours, minutes and seconds and that there are 60 seconds in a minute and 60 minutes in an hour.

They should be able to use a stop watch or stop clock to measure a time of up to one minute to an accuracy of $\pm$ 1 second.

The more able pupils who complete section 6.2 should also know that if you increase the length of a pendulum you increase the time taken for one swing but changing the weight of the pendulum does not affect the time taken for a swing.

Equipment

For section 6.0 you will need either a stop watch or clock or a watch with a second hand. For 6.1 each group of 4 or 5 pupils will need a retort stand with a boss head and clamp (see diagram in pupils workbook), a pendulum bob (any small weight will do), a 50 cm length of string and a stop watch or clock (or a watch which shows seconds).

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A Suggested
Lesson Format

Introduction

Ask the children how long it takes them to carry out certain activities, for example, to get to school and clean their teeth. When they use the terms minutes and seconds ask them to explain. What do they mean by a minute or a second? Aim to get them to tell you that these are the units we use for measuring time.

Activity

Give the pupils clear instructions on what you are asking them to do. In Section 6.0 explain that they are to count in seconds while you will use a watch to measure a period of time. Do not choose an obvious time length, such as a minute but perhaps 45 or 75 seconds. Get a number of pupils to read out their estimates before you give them your measurement.

For some classes in section 6.1 you may need to demonstrate how to make the pendulum before allowing the pupils to construct theirs. You should also demonstrate how to use and read the stop-watch or clock. When the pupils have finished ask them to take the reading for a second 20 swings and see if the two answers are the same.

During the activity you and the technician should move around the groups checking on what the pupils are doing and helping them with the experiment. If the pupils will have time to carry out activity 6.2 there is no need to stop the whole class but as you move around the groups, tell those who are finishing 6.1 to "try the next section and see what result you get".

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Discussion and Evaluation

When the activities are finished ask the different groups to write up in their own words how they made and used the pendulum and to draw a diagram of the apparatus they used. Before getting them to write, however, allow each group 5 minutes to discuss amongst themselves what they will say. Move around and help the different groups, writing on the board any words or spelling they may require. At the end of this 5 minute session you could then summarize the main points, using the 'key' words you have written on the board as an outline.

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LESSON PLAN

Unit 1 Topic 7

Time

A double period lesson. All pupils should complete section 7.0, 7.1 and 7.2.

Objectives

At the end of this lesson the pupils should know that for measurement of temperature to be accurate we must use a thermometer. They should know that we measure temperature in degrees cel ius and that the temperature of pure boiling water is 100°C and that of melting ice is 0°C. They should be able to use a thermometer to measure temperature up to 100°C to an accuracy of $\pm$ 2 degrees.

Pupils who complete section 7.2 should know that normal body temperature in human is 37°C.

Equipment

7.1 A set of 3 plastic basins (if you can get 2 sets, i.e. 6 basins it will help make the lesson more interesting).

Some hot, some warm and some cold water, towels.

7.2 Each group will need a thermometer, some melting ice and some ice with a little salt sprinkled on it. A poster of a thermometer scale.

A Suggested Lesson Format

Introduction

Ask the pupils if they have a refrigerator at home. Then ask one or two individuals to explain what a refrigerator does. Encourage them to use the word heat and then ask how do they know if something is hot or cold. Ask the pupils to discribe the difference between something which is hot and something which is cold.

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Activity

You are unlikely to have enough basins to be able to let the pupils carry out activity 7.0 in groups, so it may be easiest to set up 2 sets of (3) basins.

One set supervised by yourself and the other by the technician. Allow all the children to carry out the activity one at a time. This will involve quite a long delay so ask each pupil once he/she has tried the activity to go back to their desk and quietly discuss with the other pupils at their desk what they noticed about the temperatures in the three basins and to write down their observations in their own words.

For activity 7.0 demonstrate how to use a thermometer, emphasizing how easily it can be broken and how expensive it is to replace.

Use the scale you have drawn on your poster to help the pupils understand how to take a reading. Give clear instructions on what you expect the pupils to do at each stage of activity 7.1. Draw a table on the board and get each group of pupils to fill in their results.

With more able pupils show them how to take their body temperature. If an ordinary laboratory thermometer is used the pupils must take their temperature by placing the thermometer in their armpit rather than in their mouth.

Discussion and Evaluation

When the pupils have measured the temperature in three basins discuss with them why they think the water in the middle basin felt different to their two arms. Discuss the results each group got using the thermometer and how the results of the groups compared.

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During activity 7.2 you and the technician should check that the pupils are able to use and read a thermometer correctly, know the term degrees celcius, and know the freezing point of water.

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LESSON PLAN

Unit 1 Topic 8

Using the Gas Burner

Time

This activity may take less time than previous topics. With more able pupils it may take only a single period. If you have only double periods the extra period will give you time to revise and reinforce the objectives of the previous topics. This time could also be used to let the pupils get their written work up to date.

Equipment

Each group needs a bunsen burner, a test tube, a test tube holder and some chemical - either a little calcium hydrogen carbonate solution or a little solid ammonium chloride. (The pupils do not need to learn these names.)

Where possible use bunsen burners. If these are not available you may have to modify the lesson to suit the burners you have. Try, however, to make sure the pupils achieve the objectives. If bunsens are not available check before the lesson that you obtain both a blue and a yellow flame with your burners.

Objectives

At the end of the lesson the pupils should be able to set up and light a bunsen (or gas) burner. They should be able to adjust the size of the flame and, with the bunsen burner they should be able to obtain either a yellow (smokey) flame or a (clear) blue flame. The pupils should also know how to safely use a bunsen (gas) burner, test tube and test tube holder to heat chemicals in the laboratory.

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A Suggested Lesson Format

Introduction

Show the pupils a bottle-gas cylinder (or cartridge) and ask them to say what it is and what we could use it for. Draw on the suggestion that we could use the gas to cook or heat with. Then show the gas (bunsen) burner and say this is how we use the gas in the laboratory.

Activity

Let each pupil handle and inspect a burner and then demonstrate to them how to light it - following steps 8.1 to 8.8 in the pupils work book. Allow EVERY pupil the opportunity to connect up and light the burner. Let each person in the group do it in turn so that everyone will have carried out the activity. Let one person from each group bring up a test tube to the technician so that he can supervise them placing the chemical in their test tube.

Let them then carry out activity 8.9 and get them to record in their own words what they observe.

Discussion and Evaluation

Ask the pupils to report on what they saw when they heated the chemical. Try to encourage them to describe what they saw rather than giving a straight 'factual' answer. You can ask questions to probe their replies such as

"Did it all change at once?"
"Where did it start to change?"
"Did anything happen further up the tube?"

To evaluate the pupils understanding you can ask individuals to tell or demonstrate to the class how to connect up, light or adjust the burner. You can then ask the other members of the class to say how well he/she has done it.

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LESSON PLAN

Unit 1 — Project 2

Using What We Have Learnt

Time — A double period.

Objectives — The main objective of this lesson is to give the pupils an opportunity to use the skills they have acquired in the previous topics. At the end of this lesson they should be able to use a combination of two or more of the skills learned in the unit. They should also know that a blue flame from a burner is 'hotter' than a yellow flame and will heat a beaker of water in a shorter time than the yellow flame.

Equipment — You will need 2 beakers, 2 tripod stands and gauzes, 2 burners and 2 white tissues.

Each group of 4 or 5 pupils will need a thermometer, a measuring cylinder (to measure 50 ml of water), a beaker (100 ml if possible), a retort stand and clamp, a tripod and gauze, a stop watch (or clock) or watch with a second hand and a burner (a bunsen if possible).

A Suggested Lesson Format

Introduction — Ask individual pupils to demonstrate how to light and adjust a burner and ask the rest of the class to say how well the pupils were able to do it. Get one pupil to show both a blue and a smokey yellow flame and ask the pupil which type of flame do they see on the kerozene stove at home. (Warn pupils not to try and adjust the flame on the kerosene stove.)

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Heat beakers with a little water in them. Heat one with a yellow flame, the other with a blue flame. After one minute wipe the bottoms of the two beakers with the tissues. Show the pupils that the 'yellow' beaker has more soot on it and then ask the pupils which type of flames would they prefer to use when cooking at home. Ask them to explain their answer.

Activity

Tell the children that they are going to carry out an experiment to see if they can find another difference between yellow and blue flames. Then ask them to read their worksheet and plan with the others in their group what they are going to do. Allow the pupils 5 minutes to do this. Both you and the technician should move around from group to group asking them to explain what they will do. When each group is clear about what to do tell them, the group, that they may begin the experiment. Keep checking throughout the activity that they are following the instructions correctly.

Discussion and Evaluation

While the pupils are still carrying out the activity discuss with the groups what they are going to write in their books (for parts 5 and 6). Ask them to tell you, but encourage them to be clear and accurate about what they did and observed. Ask each group to say what their conclusion is.

During the activity you will have an ideal opportunity to evaluate the pupils skills in using the thermometer, stop watch and measuring cylinder, and burner. Help those who are having problems and where necessary show them again how to use the equipment.

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SEYCHELLES INTEGRATED SCIENCE

Unit 1

TECHNIQUES AND MEASUREMENTS

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WRITTEN BY: SCIENCE SECTION - NATIONAL INSTITUTE OF PEDAGOGY

PRODUCED AND ILLUSTRATED BY:

THE PRODUCTION, DITRIBUTION AND GRAPHIC SECTION

THE MINISTRY OF EDUCATION AND INFORMATION

REPUBLIC OF SEYCHELLES

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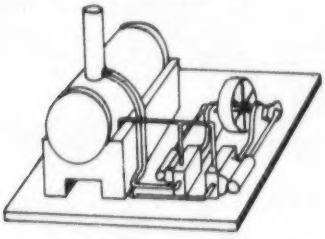
UNIT 1

TOPIC 1

LOOKING AROUND THE LABORATORY

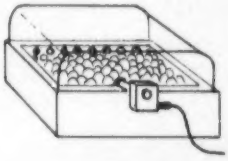
1.0 The LABORATORY is a special room where we study SCIENCE. To do TOPIC 1, you will work in a group. Your group will look at some special materials and EQUIPMENT in the laboratory. In your work book, write down the name and number of each material or piece of equipment that you use. Follow the instructions below, then write down what you OBSERVE in your work book for each.

1.1 *THE STEAM ENGINE*



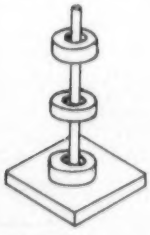
Light the fuel with a match. Put the fuel under the boiler.

1.2 *THE INCUBATOR*



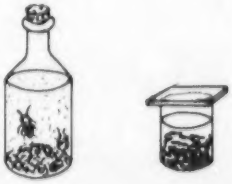
Look at the incubator. What do you think it does ?

1.3 *THE RING MAGNETS*



Arrange the magnets on the stand so that they do not touch. See if you can make them stick together too.

1.4 *THE SPECIMENS*



Look carefully at the specimens. Find out their names and where you could find them.

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UNIT 1

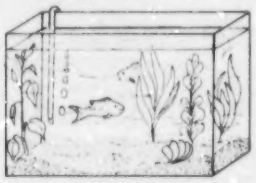
TOPIC 1

LOOKING AROUND THE LABORATORY

1.5 *THE VACUUM PUMP*

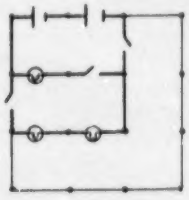
Switch on the pump. Observe what happens. Switch off the pump. Observe what happens.

1.6 *THE AQUARIUM*



Look carefully at the aquarium.

1.7 *LIGHTS AND SWITCHES*



Try to make the lights work by using the switches.

1.8 *THE MICROSCOPE*

Look at what is on the slide.
Now look down the "eye lens" at what is on the slide.
DO NOT MOVE THE MICROSCOPE.

When we study more science, we shall learn more about the things that you have just observed in TOPIC 1.

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1.9 *DO MORE - LEARN MORE*

Make a list of other things that you can observe in the laboratory that you do not find in other classrooms. Ask the technician or the science teacher to help you with their names.

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UNIT 1

TOPIC 2

USING THE LABORATORY

2.0 There are many special things in the laboratory. Some can break; some are poisonous; some are dangerous. Your teacher will explain the special rules that you must learn and obey in the laboratory.

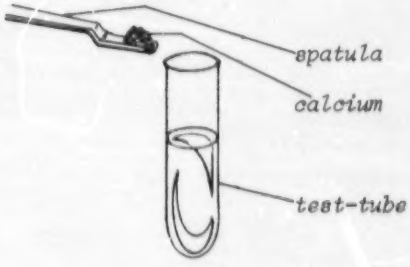
2.1 When you have understood the rules, see how many mistakes you can find in this picture of "BAD BEHAVIOUR IN THE LABORATORY"

2.2 USING CHEMICALS SAFELY

There are many materials in bottles in the laboratory. They are called CHEMICALS. Many are dangerous or poisonous, so you must be very careful with them. Your teacher will explain the rules about using CHEMICALS and GLASSWARE. Write them down; learn, understand and obey them.

2.3 A CHEMICAL CALLED CALCIUM

You are going to use a spatula to put a small piece of calcium into water in a glass test-tube.

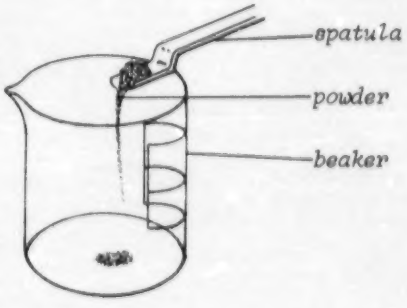


Observe what happens

Write down and/or draw what you observe in your work book.

2.4 TAKING CARE WITH CHEMICALS

Use a spatula to put a little of powder A into a glass beaker. Use another spatula to put a little of powder B into another beaker.



Add one or two drops of water to each powder.

Write down and/or draw what you observe in your work book. Add a little more water to each beaker. Write down and/or draw what you observe now.

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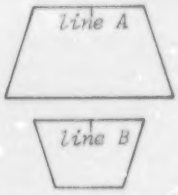
UNIT 1

TOPIC 3

GUESSING AND MEASURING LENGTH

3.0 Look at this drawing:-
Which line looks longer, line A or line B ?



Write your guess in your work book.
Now use your ruler to MEASURE the lines, and record your answers.

Which is more accurate, guessing or measuring ?

3.1 Your teacher will show you a METRE RULER. It is exactly 100 cm or 1 metre long. Look at it and then try to guess:

- the length of the laboratory.
- the width of the laboratory.
- the height of the laboratory.

and in the agriculture project:

- the width of one seed bed.
- the space between two plants.
- the length of a farm building.

Write your guesses in your work book. Now measure them with a metre ruler. Write your measurements in your work book.

Which is more accurate, guessing or measuring ?

3.2 Try to guess these before you measure them:-

- the length of your table
- the length of the blackboard
- the distance around a milk tin *
- the distance around a bell jar *

* You will need to use some string to help you measure these. Describe in your work book how you do so.

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UNIT 1

TOPIC 4

GUESSING AND MEASURING WEIGHT

4.0 Your teacher will give you a bag that weighs 1/2 kilogram (500 grams).

Hold the bag in one hand; hold something else in the other hand and try to guess its weight:

For example:

- your science book
- a light sandal
- an empty bottle
- a bottle full of water

4.1 Now use a BALANCE to measure the exact weights in grams. Write down the exact weight in your work book.

Did you guess all of the weights accurately ?

4.2 Find out:

- the weight of water in a bottle
- the weight of one page of your science book
- if the weight: "NET WT" on a tin of milk means:
  the weight of the milk only
  or:
  the weight of the tin and the milk.
- which of these tins of coffee is the best value for money ?

Size of coffee tin	Weight	Price (Rs)
Small	50 g	10.00
Medium	100 g	19.00
Large	200 g	37.00

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UNIT 1

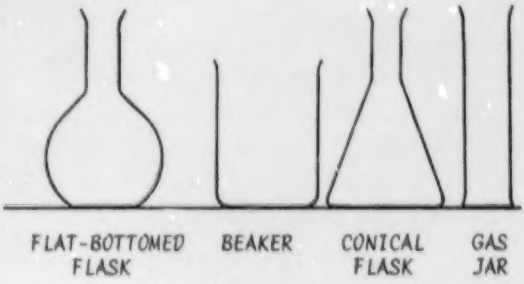
TOPIC 5

GUESSING AND MEASURING VOLUME

5.0 The VOLUME of something is the amount of space that it takes up.

Guess which of these has the most volume:

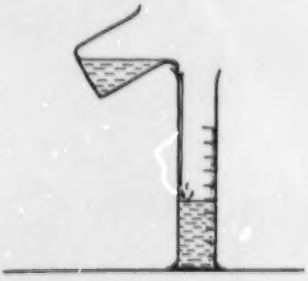
How could you find out if your guesses are correct ?

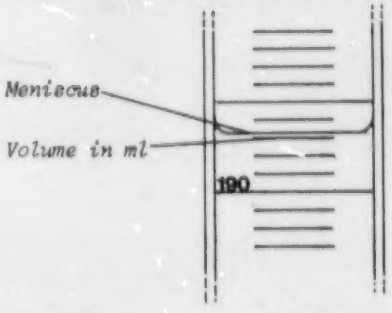


5.1 We measure volume in MILLILITRES (ml) and in LITRES (l).
Guess how many millilitres (ml) you need to fill each of the above.

Write down your guesses in your work book.

5.2 Use a measuring cylinder to measure the volume of each container.
Write down your answers. Did you guess them all correctly ?





5.3 Guess what volume of water each one of these can hold, and then measure them:

- a teaspoon
- a table spoon
- a cup
- a lemonade bottle

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UNIT 1

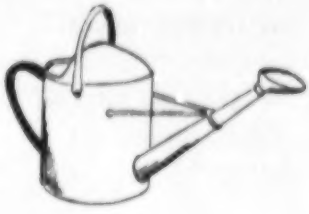
PROJECT 1

USING WHAT WE HAVE LEARNT

We shall now use what we have learnt to help us to solve problems in the school agriculture project:

PROBLEM 1

Look at a watering can:
Guess what volume of water it can hold. Now measure how much it can hold.
Write down one or two sentences in your book to explain how you did this.

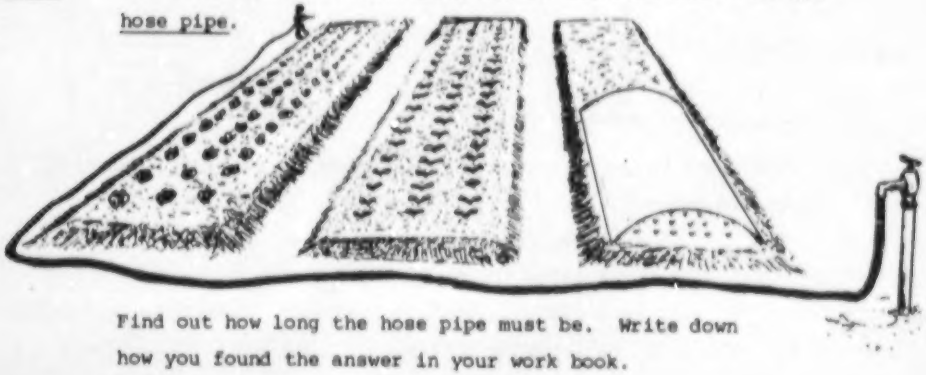


PROBLEM 2

Look at the fruits and vegetables growing in the agriculture project. Write down their names. Choose one that has fruits or vegetables on the plant, and guess the weight of the biggest one.
Now think of a way to measure its weight without taking it off the plant.
Write down one or two sentences to say how you did this.

PROBLEM 3

The technician wants to water all of the seed beds with the hose pipe.



Find out how long the hose pipe must be. Write down how you found the answer in your work book.

SIS

UNIT 1

TOPIC 6

GUESSING AND MEASURING TIME

6.0 When the teacher says "START", close your eyes and count seconds.

When the teacher says "STOP", write down the number that you have counted to in your work book.

Find out the real number of seconds from the teacher.
Could you guess time accurately ?

6.1 *THE PENDULUM*

Some clocks keep time using a PENDULUM.
Make a pendulum that is 30 cm long using

- a stand and clamp
- a small heavy weight
- a light string

We can measure time accurately with a STOPWATCH or a STOPCLOCK.
Use a stopwatch or clock to measure the time that the pendulum takes to make 20 swings.

Do all of the pendulums made by the other groups in the class give the same answer ?

6.2 Find out what happens to the time it takes

- if you make the string half of the first length
- if you make the string twice the first length
- if you make the weight heavier

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UNIT 1

TOPIC 7

GUESSING AND MEASURING TEMPERATURE

7.0 The TEMPERATURE of something means how HOT or COLD it is.
We often use our hands to guess temperature: -

HOT WATER

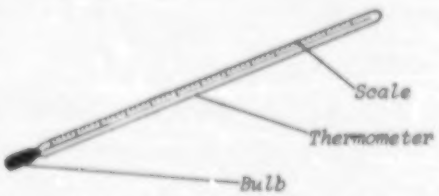
WARM WATER

COLD WATER

Put one hand in the hot water, and the other hand in the cold water. Leave them there for about 30 seconds. Then put both hands into the warm water.
Do both hands feel the same temperature ?
Do you think that your hands are good at guessing temperature ?

7.1 Your teacher will show you how to use a THERMOMETER to measure temperature. Use it to measure :-

- the temperature of the water in each of the bowls (above).
- the temperature of your hand.



Look at the temperatures that you recorded for your hand, for the hot water and for the cold water. Try to explain why the hot water felt hot and the cold water felt cold to your hand.

7.2 Use the thermometer to measure some other temperatures:

- melting ice
- melting ice with salt
- the air in the laboratory

7.3 Find out:
- how to measure the temperature of your body
- what your normal body temperature is
- what happens to your body temperature when you have a fever.

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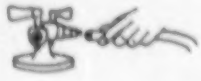
UNIT 1

TOPIC 8

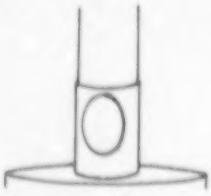
USING THE GAS BURNER

8.0 In the laboratory, we use a GAS BURNER to heat things. Your teacher will explain the rules for using the GAS and for using the BURNER. The pictures below show how to use a "Bunsen" burner with the gas:

8.1 Push the rubber hose over the gas tap.



8.2 Close the airhole.



8.3 Light the match or splint.

8.4 Turn on the gas tap.

8.5 Light the gas coming from the burner.

8.6 Open the airhole.

8.7 Carefully turn the tap to make the flame about 5 cm high.

8.8 When heating a test-tube, do not point it at yourself or anyone else.

Always use the test tube holder.
Turn off the gas after you have finished heating.

8.9 Your teacher will give you a test-tube and a chemical. Put this chemical into the test-tube and heat it CAREFULLY. Use a test-tube holder because the tube will be hot.
Write down what you observe when you heat this chemical.

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UNIT 1

PROJECT 2

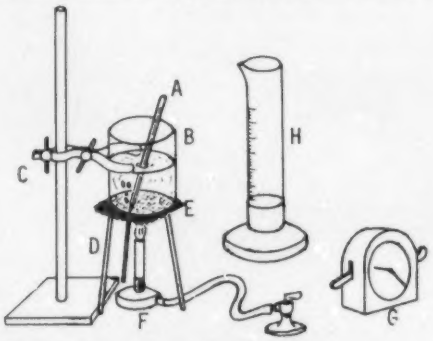
USING WHAT WE HAVE LEARNT

We are going to do an "EXPERIMENT" to find out: -

- the temperature of boiling water in degrees Celsius (°C).
- how much time 50 ml of water takes to boil using a blue gas flame.
- which colour of flame (blue or yellow) is best for boiling water.

We will need: -

Diagram of the equipment for Project 2



A - a thermometer to measure the temperature in °C.

B - a beaker to hold the water.

C - a clamp and stand to hold the beaker.

D - a tripod to support the beaker.

E - a gauze to stop the beaker from breaking when it is heated.

F - a burner to heat the beaker of water up to boiling.

G - a clock to measure the time the water takes to boil.

H - a measuring cylinder to measure 50 ml of water.

INSTRUCTIONS

1 Arrange the equipment in the same way as in the *"Diagram"* above.

2. Measure the temperature of the water - record it in your work book.

3. Start the clock when you start to heat the water.

4. When the water boils:
   - stop the clock.
   - measure the temperature of the boiling water.
   - turn off the heat.

5. Write down a few lines in your work book about what you did and what you observed while the beaker cools down.

6. Repeat your experiment, using fresh water and a yellow flame. Write down your observations and your CONCLUSIONS (what you found out).

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